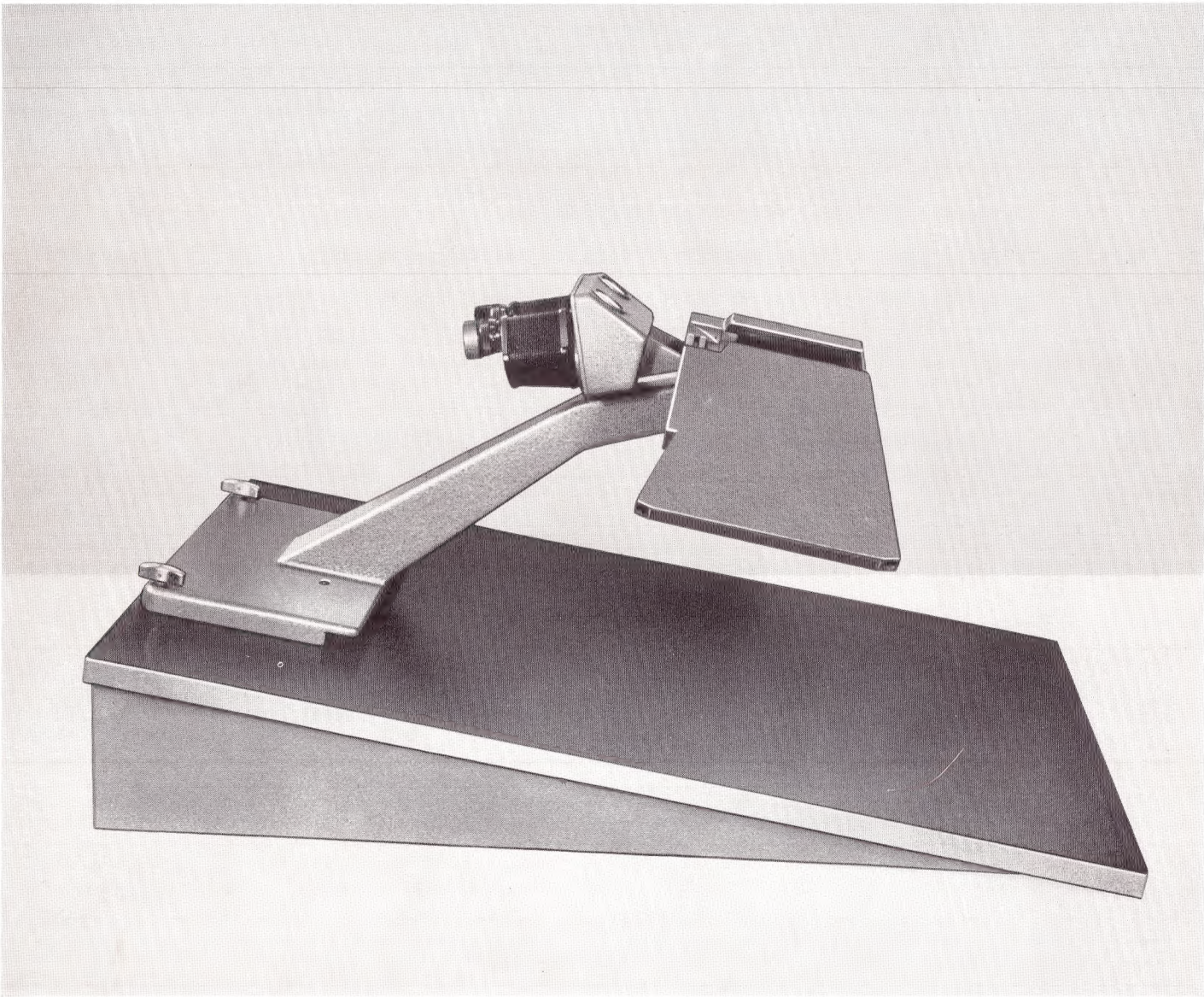


ZEISS

**Standard N 2
Mirror Stereoscope**



Technical data



1

Viewing base on photograph	210 mm	Magnification with magnifier attachment in place	<u>6x</u>
The emmetropic eye sees the virtual image formed by the stereoscope at a distance of	approx. 1 m	field of view	<u>32 mm</u>
Magnification for overall viewing	<u>.1x</u>	entrance pupil	2 mm
field of view	190 mm x 230 mm	interpupillary distance adjustment . . .	55 to 70 mm
entrance pupil	30 mm	diopter setting	± 7

Purpose of instrument/design principle

Outstanding features

Large angular field, thus excellent overall view.

Rugged construction.

No rotation of the large mirrors, thus high stability of adjustment.

No movement of B-prisms (Fig. 2), thus uncomplicated design.

Common seating and handling of left-hand and right-hand magnifier attachment, thus simple operation.

Unusually large distance between removable legs, as referred to the photo base.

Stereomicrometer connected to supporting arm via holding bracket (thus simplified parallax measurement).

No alteration of base during interpupillary distance adjustment.

Possibility of combination with:

supporting arm,

inclined desk

and tiltable L 2 Viewing Desk.

Purpose of instrument

The impact of photographs of objects, surfaces, textures or transient events is considerably increased by stereoscopic viewing of a so-called photo pair. The resulting **three-dimensional image** facilitates the interpretation of object details and shows the object photographed with measurable depth.

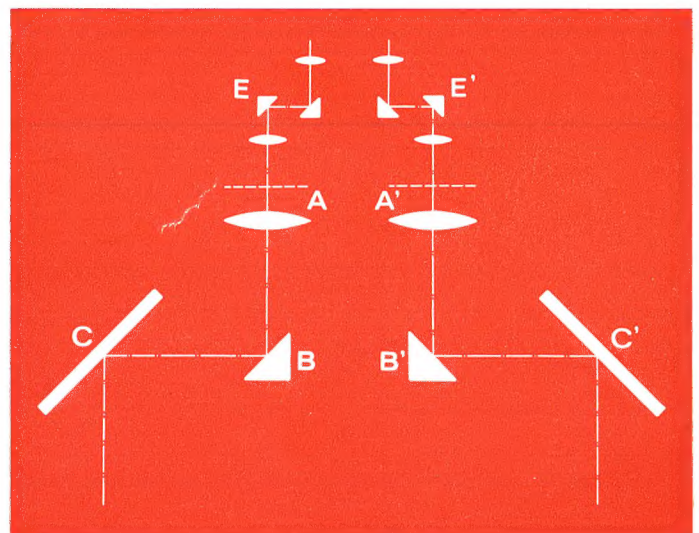
In order to be able to view and plot such photographs of relatively large size with varying magnification, so-called mirror stereoscopes have long been used. The N2 Mirror Stereoscope, successor to various models of stereoscopes manufactured by this company during the last few decades, is a mature instrument of functional design. When the instrument is used without its magnifier attachment, the field of view attained thanks to the amply dimensioned mirrors is such that the model area of 9" x 9" (23 cm x 23 cm) aerial photographs can be covered without any displacement of the photos.

Stereoscopes for large-format photos are primarily used for stereoscopic viewing and exploration of aerial photographs in the field of so-called **photo interpretation** (e.g. forestry, geology). In the field of **photogrammetry** they are used, among other things, for point transfer (aerotriangulation). Exploratory work for engineering projects is considerably facilitated by the use of stereoscopes. In the field of medicine, the stereoscopic examination of X-ray photographs may yield additional information on the object to be studied.

Design principle

The parallel displacement of the viewing beams from the observer's eye by means of two reflections at each of the points B and C (Helmholtz' mirror stereoscope) permits relatively large photographs to be placed under the stereoscope without any mutual overlap (Fig. 2). The use of a magnifier attachment of the binocular type (Figs. 1 and 4) allows the interpupillary distance to be set in a simple manner.

In the N 2 Mirror Stereoscope, the reflections at C and C' are produced by mirrors. The other reflections are obtained with the aid of prisms. In addition, there are additional prisms between E and A as well as E' and A' folding the light path as required for the inclined position of the eyepieces.



Application of N 2 Mirror Stereoscope

In its **basic form**, the N2 Mirror Stereoscope is mounted on four removable legs (Fig. 3). The photos, secured to the table with Scotch tape that is adhesive on both sides, are viewed under unity magnification, and if it is desired to have marginal portions more in the center of the field, the entire stereoscope can be shifted, using the legs as handles. A wide range of displacement is provided by the exceptionally large distance between legs.

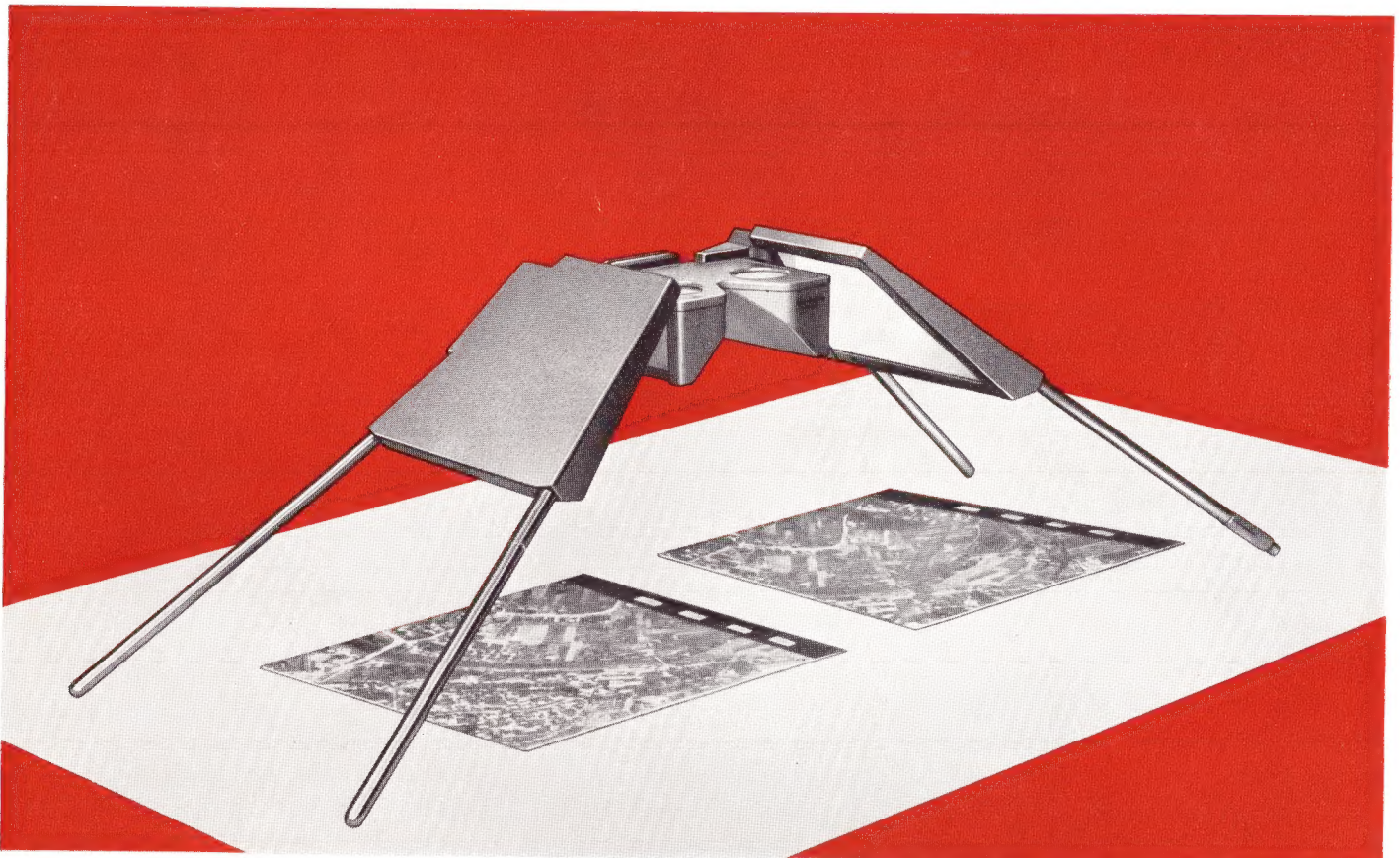
If the photos are to be viewed under higher magnification, a **magnifier attachment** can be swung into position (Fig. 4). This attachment has inclined eyepieces allowing the observer to assume a convenient working posture. The magnifier attachment can be hinged back or removed quite simply.

If a completely free working surface is desired under the stereoscope, it is advisable to attach the instru-

ment to a **supporting arm** (Fig. 5) which is mounted directly on the table by means of two screws. Here, the photographs are held by permanent magnets to a photoholder plate, so that they can be displaced as a whole.

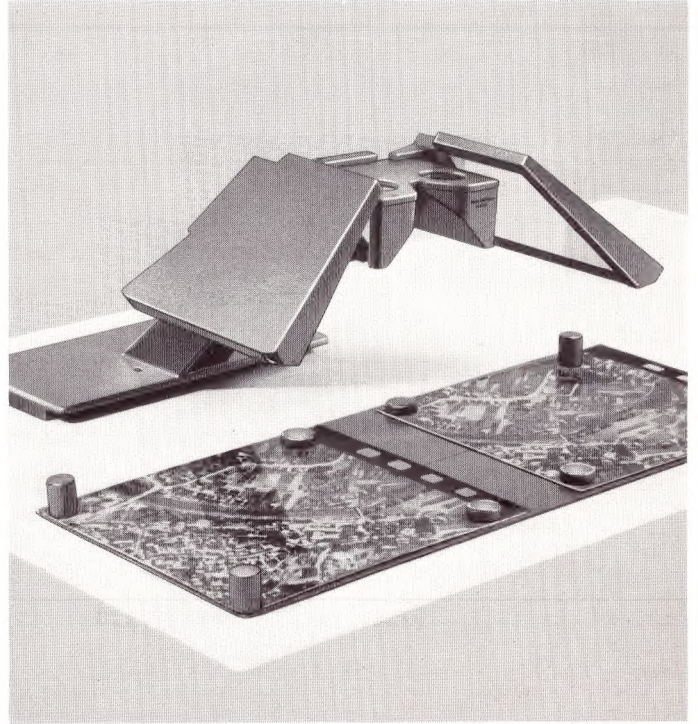
In the latter and the following two combinations, a **stereomicrometer** may be used, which permits simple height measurements to be made on the photos (Fig. 6). The two measuring marks of the stereomicrometer appear to the observer as a floating mark, the height of which can be measurably varied. The difference between the readings taken at the micrometer thimble of the stereomicrometer is the height parallax from which the height differences can be computed.

If the stereoscope and its supporting arm are mounted on the **inclined desk**, a very convenient working posture is possible also for 1 : 1 viewing (Fig. 7).

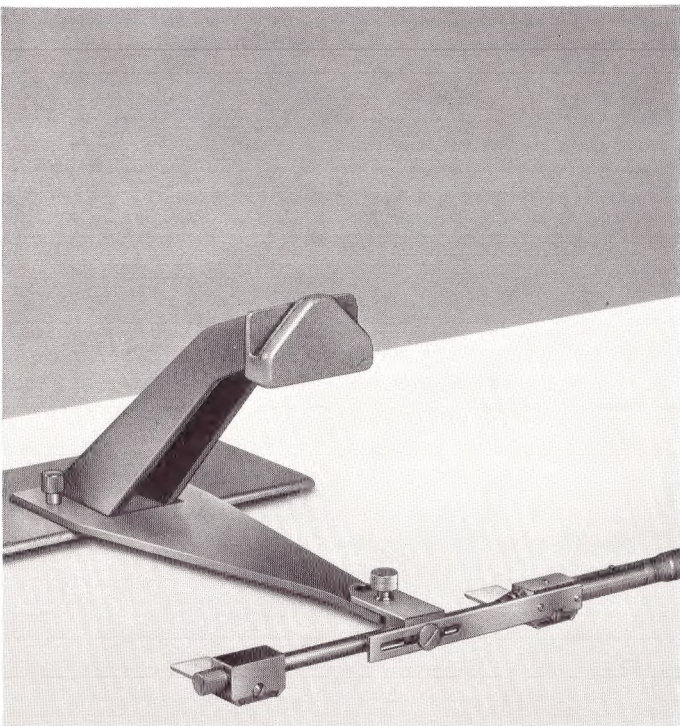




4



5

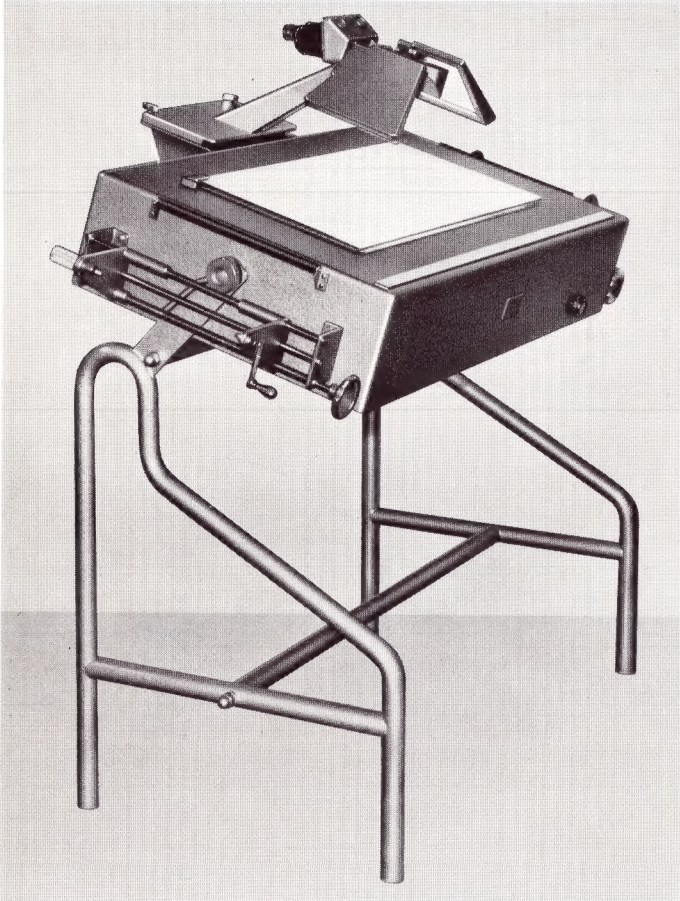


6

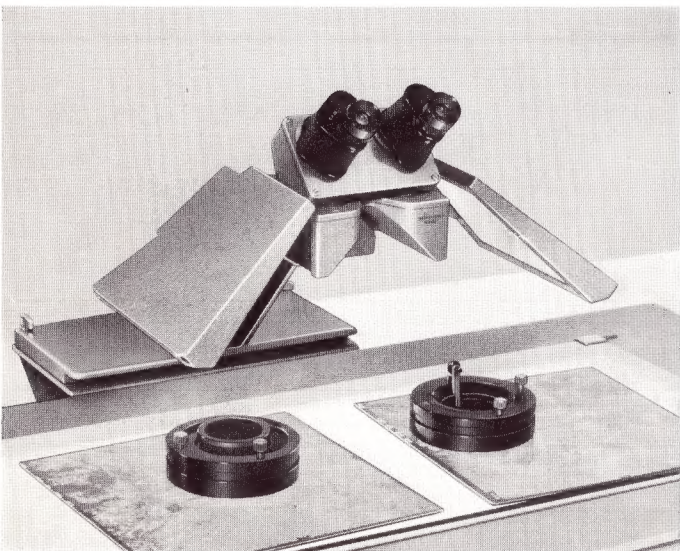


7

Use of the instrument



8



9

The stereoscope on the **L 2 Viewing Desk** constitutes an assembly suited for viewing transparent photo pairs (Fig. 8). For this purpose, the hinges of the cover glass plate are removed from the viewing desk and the diapositive pair is mounted on the glass plate. The photo pair can then be shifted under the stereoscope together with the glass plate.

If two so-called "**snap-markers**" and possibly an additional "**pointing instrument**" (Fig. 9) are added, the assembly is then well suited, for example, for stereoscopic point transfer in connection with aerotriangulation. In this process, tiny artificial marks of 0.1 mm diameter are made in the emulsion of the diapositives at suitably located, homologous points. Fig. 9 shows a pointing instrument on the left, and a snap marker on the right.

General

In the case of aerial photography, the photographs to be studied should have about 60 % overlap, and they should be taken with almost parallel axes. A base-height ratio of 1 : 10 to 1 : 20 is suitable for terrestrial photography.

The observer should be facing the light, but direct illumination (which would create disturbing reflections on the surface of the photos) should be avoided.

Before observation starts, the diopter value set on the eye lenses should be checked as well as the interpupillary distance adjusted on the magnifier attachment (free-handed adjustment).

Orientation of photographs

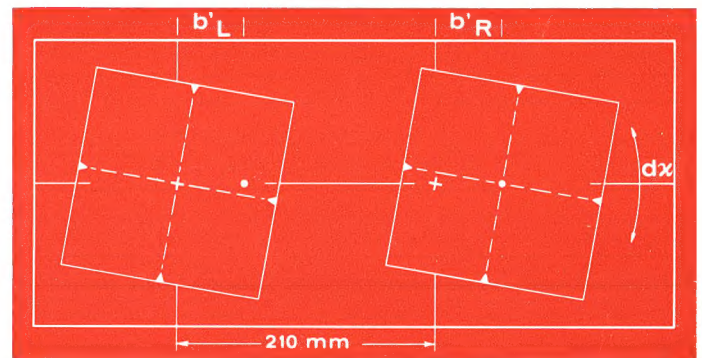
The stereoscopic photographs should preferably be oriented according to epipolar rays.

At first, the center (principal point) is marked on each photo by two short pencil lines. This point is found at the intersection of the lines joining the centers of the fiducial marks at the edges of the pictures. Then the principal point of the left-hand photo is found in the right-hand picture and vice versa, the two principal

points on each photo being joined by a ruler and the corresponding line marked with pencil at the edges only. Both photos are then mounted on the photoholder plate or directly on the table so that the two lines at the edges form one straight line. The distance between the two photos is chosen so that there are 210 mm (standard basis of N 2 Mirror Stereoscope) between the principal point of the left photo and its locus on the right photo. This is shown in Fig. 10. If it is desired to work without the magnifier attachment, it may be found of advantage to mount the photos with a separation of about 200 mm.

During observation, the photoholder plate or the stereoscope proper should be shifted by slight

amounts of dx so as to eliminate troublesome y-parallax.



10

Formulae for simple measurements on aerial photos

- If
- h_o = flight height above mean ground elevation
 - f = focal length of aerial camera
 - s = distance on the ground
 - s' = corresponding distance on the photo (as measured with ruler)
 - b' = photo base (mean of b'_L and b'_R , cf. Fig. 10)
 - Δh = topographic relief
 - Δp = parallax difference (as measured with stereomicrometer)

then the following formulae apply to vertical photography, which would be encountered in any photogrammetric text-book:

For computing the flight height from distance measurements, using the mean of two diagonal distances, if possible:

$$h_o = \frac{s}{s'} \cdot f \quad (1)$$

For computing relief heights from parallax measurement:

$$\text{rigorously: } \Delta h = -\Delta p \frac{h_o}{b' + \Delta p} \quad (2)$$

$$\text{approximately: } \Delta h \approx -\Delta p \frac{h_o}{b'} \quad (2a)$$

(applicable if Δp is smaller than about 3 mm)

For computing ground distances from image distances:

$$s = \frac{h_o \cdot s'}{f} \quad (3)$$

Example for (1):
(determination of flying height)

$$s = 2 \text{ km}$$

$$s' = 90 \text{ mm}$$

$$f = 153 \text{ mm} :$$

$$h_o = 3.4 \text{ km}$$

Example for (2 a):
(measurement of tree height)

$$h_o = 3400 \text{ m}$$

$$b' = 92 \text{ mm}$$

$$p = 0.66 \text{ mm} :$$

$$h = 24.4 \text{ m}$$

Example for (3):
(distance measurement)

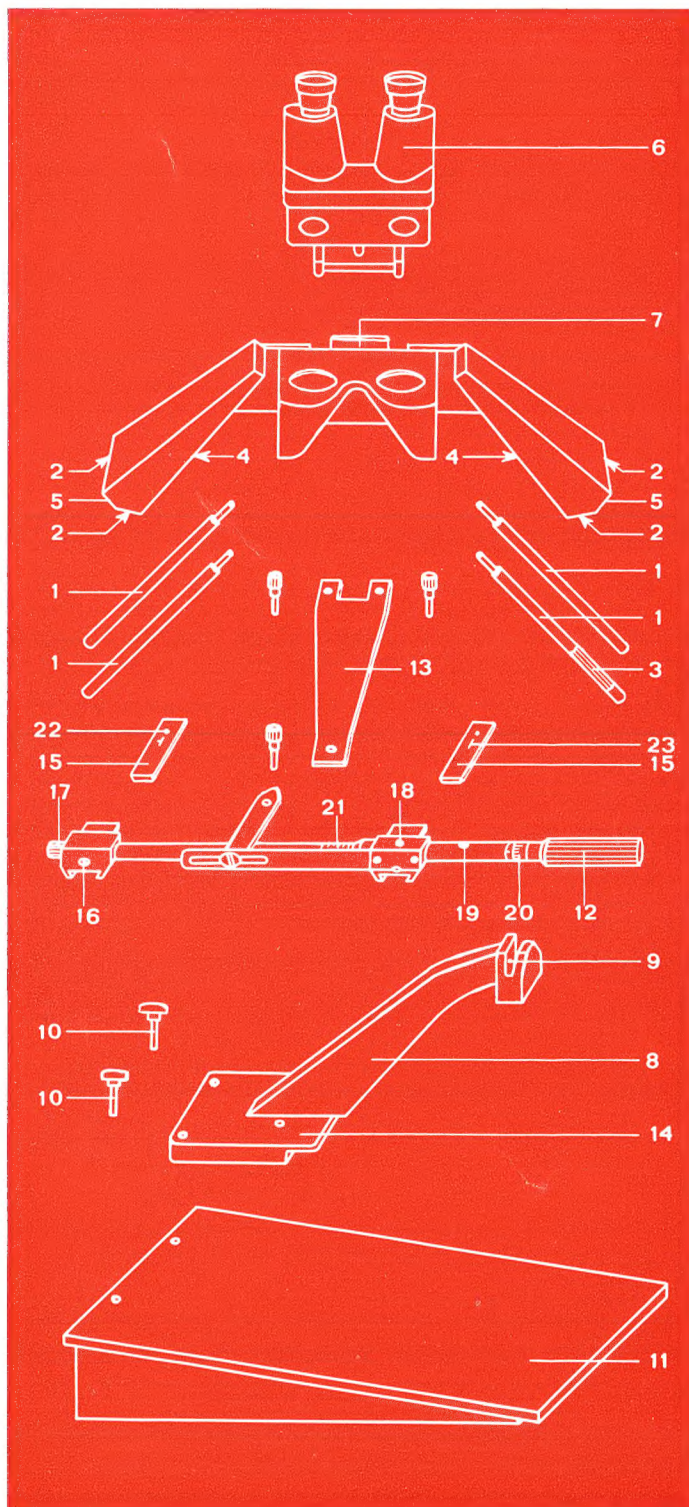
$$h_o = 3400 \text{ m}$$

$$f = 153 \text{ mm}$$

$$s' = 17.3 \text{ mm} :$$

$$s = 385 \text{ m}$$

The accuracy of the final result depends above all on the degree to which the photography is rigorously vertical.



Basic equipment N 2

The four removable legs (1) are pushed all the way into the mirror holder (2).

The extension piece (3) is rotated until the stereoscope rests firmly on all four feet.

The mirrors (4) are provided with a special protective coating. In addition, the extended mirror mount (5) serves as a protection against accidental contact between fingers and mirrors.

Magnifier attachment:

The magnifier attachment (6) can be slipped vertically downwards into the joint (7) only in the position shown in the illustration.

Supporting arm:

The stereoscope is mounted on the supporting arm (8) by simply sliding it into the slot (9).

Inclined desk:

The supporting arm (8) itself is mounted on the inclined desk (11) by means of two screws (10).

Stereomicrometer (12):

The holding bracket (13) is screwed to the cast plate (14). Damaged measuring mark plates can be easily exchanged by withdrawing them from their mounts. Leaf springs must be inserted on the inner side of the mounts. The basic distance between the measuring marks of the stereomicrometer can be varied after loosening the clamp screw (16) on the screw (17). In addition, the right-hand measuring mark holder can be displaced by a fixed amount of 5 cm, if an adaptation to mirror stereoscopes with a base of, for instance, 26 cm should become necessary. For this purpose, the screws (18 and 19) are removed.

$\frac{1}{100}$ mm can be accurately read on the scale (20) divided into intervals of 0.05 mm. The corresponding millimeter graduation is at (21).

The measuring mark (22) is yellow, so that it will stand out against the photographic emulsion.

Under stereoscopic observation the T-marks (23) show that there is no y-parallax. In this case, they fuse into a cross.

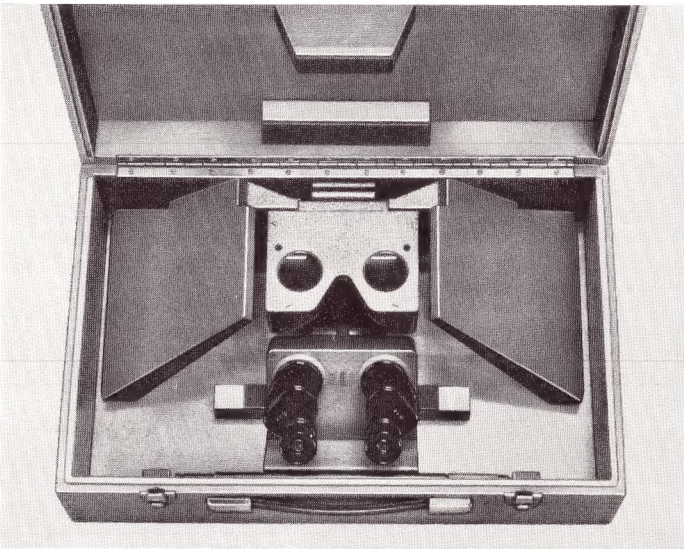
Order data for the equipment
mentioned in this folder

Packing

The type of packing is evident from Figs. 12 and 13.

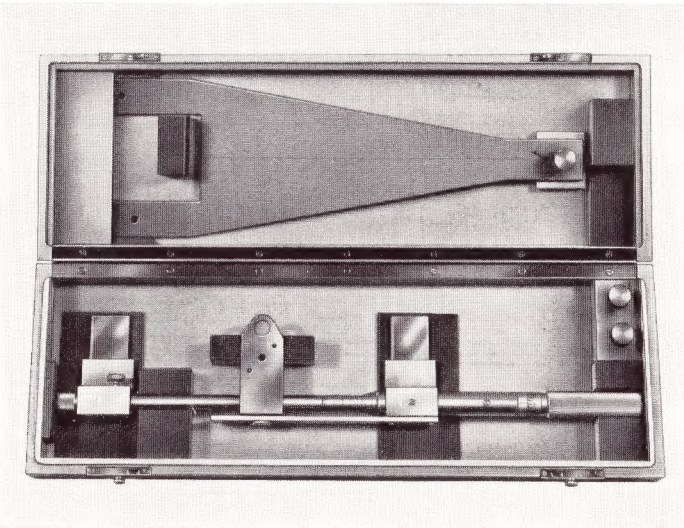
Maintenance:

Apart from occasional dusting, the stereoscope requires practically no maintenance. If necessary, mirrors and glass surfaces should be cleaned very carefully with a cotton wad dipped in alcohol. Care should be taken not to touch the enameled metal parts with the solvent.



12

13



	Cat. No.	Weight (lbs.)
1. N 2 Mirror Stereoscope with removable legs, in case (as in Fig. 3)	51 53 14	11.25
2. N 2 Mirror Stereoscope with removable legs and magnifier attachment, in case; in addition: supporting arm, photoholder plate with 8 permanent magnets and inclined desk (as in Figs. 5 and 7)	51 53 13	28.66
3. SMM Stereomicrometer with holding bracket, in case (as in Fig. 6)	51 67 05	3.97
4. L 2 Viewing Desk (as in Fig. 8)	51 54 51	105.84
5. KS Snap Marker in case (as in Fig. 9)	51 50 11	2.43
6. ES Pointing Instrument in case (as in Fig. 9)	51 50 12	3.09

We reserve the right to depart from the catalog specification.

The illustrations are not binding in every detail for the design of the instruments.

We shall be glad to provide cuts or glossy photographs for scientific publications. For reproduction of illustrations or text, please consult us.

Kindly contact your nearest Carl Zeiss representative or write directly to Carl Zeiss, Oberkochen/Wuerttemberg, West Germany, on all questions of operation, maintenance, or repair of our instruments, and the supply of spare parts.



CARL ZEISS Oberkochen/Württ.

Mailing address: 7082 Oberkochen/Württ.

West Germany

Carl-Zeiss-Strasse · Postfach 35/36

Telephone: (07364) 381 · Telex: 7-13213

Cables: Zeisswerk Oberkochen